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14. ABSTRACT

Controllable thrust propulsion for the next generation of tactical missiles (NLOS PAM) is providing significant mission flexibility and increasing the system capability with precision performance. Thrust propulsion within a tactical missile is controlled by a pintle/throat configuration. The purpose of the pintle/throat configuration is to maximize the thrust within the rocket motor to successfully propel the missile. Rhenium, due to its high thermal and mechanical properties, is the best acceptable, high-temperature, and corrosion resistant material for managed-energy tactical propulsion systems. The NCDMM, along with Plasma Processes, Inc. (PPI), and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), have been requested to optimize the manufacturing process in order to reduce the cost of the pintle/throat combinations. This will be accomplished by replacing solid rhenium with rhenium coatings fabricated by Plasma Processes' El-Form electrodeposition process.

15. SUBJECT TERMS
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Reduce Manufacturing Costs of Ultra-High Temperature Rhenium Pintle/Throat Combinations

NCDMM Project No. 05-0073-10

Technical Report

PROBLEM / OBJECTIVE

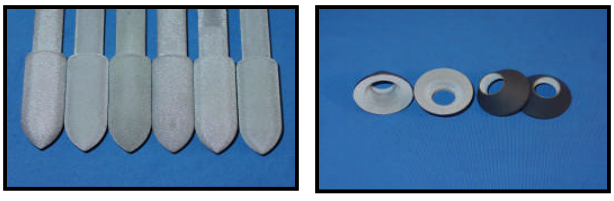
Controllable thrust propulsion for the next generation of tactical missiles (NLOS PAM) is providing significant mission flexibility and increasing the system capability with precision performance. Thrust propulsion within a tactical missile is controlled by a pintle/throat configuration. The purpose of the pintle/throat configuration is to maximize the thrust within the rocket motor to successfully propel the missile. Rhenium, due to its high thermal and mechanical properties, is the best acceptable, high-temperature, and corrosion resistant material for managed-energy tactical propulsion systems.

The NCDMM, along with Plasma Processes, Inc. (PPI), and the Aviation and Missile Research, Development, and Engineering Center (AMRDEC), have been requested to optimize the manufacturing process in order to reduce the cost of the pintle/throat combinations. This will be accomplished by replacing solid rhenium with rhenium coatings fabricated by Plasma Processes' El-Form™ electrodeposition process.

ACCOMPLISHMENTS / PAYOFF

Process Improvement

In a previous effort, PPI had successfully machined the pintles and throats from lightweight graphite substrates. Utilizing their El-Form™ rhenium deposition process, PPI successfully coated these graphite pintles and throats with a rhenium coating in several thicknesses for testing.



Rhenium Coated Graphite Pintles/Throats

During previous "Hot Fire" testing (several iterations of boost and sustain cycles) of the pintle/throat combinations, a minimum thickness of rhenium coating for the throat was established. However, a minimum thickness of rhenium coating for the pintle was not.

The NCDMM, PPI, and AMRDEC were successful in optimizing the processes to achieve the goal of producing lightweight rhenium coated pintle/throat combinations with a 90% reduction in costs. The following goals were accomplished to make the 90% cost reduction possible:

- Selection of pintle/throat size and geometry
- Determination of minimum coating thickness per component
- Increase deposition rates
- Reduce/eliminate post-deposition machining
- Optimize manufacturing processes to increase throughput per run

Implementation and Technology Transfer

With an initial capital investment of $950K, production of the pintle/throat combinations can be increased from 1,000 combinations per year to 3,000 combinations per year. In addition to the increased capacity and significant cost reduction, an 80% reduction in weight per combination will be achieved.

Expected Benefits

Plasma Processes, Inc. has estimated a cost savings/cost avoidance of $6,100 per pintle/throat combination utilizing the rhenium coating process. The result of this effort will produce an annual cost savings/cost avoidance of $6.1M per year based on the current production of approximately 1,000 missiles/year. Plasma Processes anticipates increasing production to 3,000 missiles per year, resulting in an estimated $18.3M per year cost savings/cost avoidance utilizing the efforts of this project.

TIME LINE / MILESTONE

Start Date.....September 05
End Date.....June 06

PROJECT FUNDING

NCDMM Funding.....$225K

PARTICIPANTS

Aviation and Missile Research, Development, and Engineering Center (AMRDEC)
Plasma Processes, Inc.

For additional information concerning this project, contact the NCDMM at www.ncdmm.org